REMARKS

Claims 1-9 and 18-45 are all the claims pending in the application.

I. Preliminary Matters

Claims 1-9 and 18-45 are pending in the application. Claims 18-29, 35-37, 39, and 40 have been withdrawn from consideration. Claims 1-9, 30-34, 38, and 41-45 are rejected.

On page 2 of the Office Action, the Examiner indicates that the rejections under 35 U.S.C. § 112 have been withdrawn.

II. Claim Rejections under 35 U.S.C. § 103 based on Ochoa

Claims 1, 5, 6, 8, 30-33, 38 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ochoa et al. (U.S. Patent Application Publication No. 2003/0099883).

The Examiner maintained the rejection as set forth in the Office Action dated January 10, 2011.

Further, the Examiner considered that Ochoa provides teaching, suggestion and motivation to alter the porosity of the electrode in paragraphs [0010], [0011], [0015] and [0017]. While acknowledging that Ochoa teaches that increasing porosity to lower thermoelectrical conductivity is preferable due to ease of manufacture, the Examiner argued that one cannot disregard that Ochoa also teaches that, "High porosity tends to reduce thermal and electrical properties of electrodes" (paragraph [0010]) and that porosity generates heat-traps that lower the heat transfer capability of composite systems such as electrodes, and that materials with high porosity tend to exhibit decreased heat conduction (paragraph [0011]). Thus, the Examiner asserts that the optimization of the porosity of the electrode would have been obvious to one of ordinary skill in the art to balance the properties of thermal and electrical properties, ease of

manufacture, heat conduction and transfer within the electrode and the cost of the electrode (see paragraphs [0004], [0010], [0011], [0015] and [0017]).

The rejection should be withdrawn because Ochoa does not disclose, teach, or suggest an electrode having a porosity of 25% or less. Moreover, Ochoa teaches away from an electrode having a low porosity of 25% or less because it concretely states in paragraph [0017] that "[i]ncreasing porosity to lower thermoelectrical conductivity is preferable due to the ease of manufacture" (emphasis added). In the paragraphs cited by the Examiner, Ochoa is merely discussing that the porosity can be manipulated by increasing or decreasing it, and that a combination of carbon nanotube and carbon black could "perhaps" provide an electrode with optimum low porosity. Ochoa nevertheless fails to disclose a specific porosity range. Thus, based on the disclosure of Ochoa, one of ordinary skill in the art would not have lowered the porosity to specifically 25% or less.

The Examiner asserts that the porosity calculation of cathode #1 in Table 4 of Ochoa is not relevant to the claim rejection because there is no carbon black within the electrode. Further, the Examiner asserts that porosity calculations would have to be done for each and every example given in order to conclude that Ochoa does not teach an example of an electrode which has a porosity of 25% or less.

Applicants respond as follows.

(1) Porosity calculation of the cathodes of Ochoa other than cathode #1 in Table 4:

Regarding anodes (negative electrodes), Applicants are unable to calculate a porosity since Ochoa has no description of electrode density in the specification. However, the porosity

values of the anodes (negative electrodes) of Ochoa are presumed to be much higher than 25% (and therefore well outside the scope of the claimed invention) for the following reasons.

Ochoa teaches in paragraph [0010] that high porosity of cathodes tends to reduce thermal and electrical properties of electrodes. Further, this effect is more dramatic on the cathode materials than on carbon based anode materials due to the low thermo-electrical conductivity of common positive electrode materials of batteries. That is, Ochoa recognizes that since negative electrode materials are based on graphite materials having high thermo-electrical conductivity, there is no need for lowering the porosity of the electrodes. Therefore, it is unlikely that the porosity values of the negative electrodes are lower than those of the positive electrodes (cathodes) shown in Table 4.

The present density of the electrodes is 80 kgf/cm^2 on the positive electrodes, as compared to 50 kgf/cm^2 on the negative electrodes. With respect to carbon fiber electrodes, a considerable high press density is required to lower the porosity. This is because carbon fibers are difficult to deform even with fairly high pressure due to their onion-shaped crystal structure. That is, it is very unlikely that the porosity values of the negative electrodes are lower than those of the positive electrodes (cathodes) in Table 4.

Table 2 of Ochoa shows that the Porous Graphite (Graphite Grade 60) has a porosity of 52% and a thermal conductivity of 85.5 W/mk. Since the Graphite Anode #1 in Table 4 has a thermal conductivity of 60.5 W/mk, Ochoa seems to assume a porosity (density) of about 50%, and it is unlikely that Ochoa assumes a porosity as low as 25%.

Applicants have provided sound technical reasons showing that cathodes #2 to #4 of Ochoa have porosity values well outside a porosity of 25% or less as claimed. If the Examiner disagrees, she is respectfully requested to provide rationale or evidence to the contrary.

Applicants further question why a person having ordinary skill in the art would have had a reason to use an electrode having a porosity of specifically 25% or less. Particularly, optimization of the electrode porosity to 25% or less is not obvious because it is not reasonably expected that an improvement in the electrolytic solution permeability and other characteristics will arise in that range. As Applicants teach on page 5 of their specification, conventionally employed electrodes have a porosity of more than 25%. One of ordinary skill would generally consider that a porosity of 25% or less results in a decrease in the permeability of the electrolytic solution and a decrease in the charging/discharging performance and cycling characteristics.

Regarding this last point, although Ochoa may provide some motivation to increase the electrode density, one of ordinary skill would assume that the porosity is lowered to about 50% at most based on the disclosure of Ochoa, and would not assume a porosity of as low as 25%, taking into consideration the problem of permeability of the electrolytic solution. Therefore, it is respectfully submitted that the rejection over Ochoa is based on mere hindsight.

For the above reasons, it is respectfully submitted that the present claims are patentable over Ochoa, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

III. Claim Rejections under 35 U.S.C. § 103 based on Frysz

Claims 1, 3, 5, 6, and 30-34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Frysz et al ("Carbon filaments as a conductive additive to the manganese

dioxide cathode of a lithium electrolytic cell"; Journal of Power Sources; Vol. 58; 1996; pp. 41-54), in view of Nishimura et al. (European Application No. EP 1191131).

The Examiner maintained the rejection as set forth in the Office Action dated January 10, 2011.

The above rejection should be withdrawn because Frysz at least does not disclose, teach, or suggest an electrode having a porosity of 25% or less. Further, Nishimura also does not disclose, teach or suggest an electrode having a porosity of 25% or less, and thus does not make up for the deficiencies of Frysz.

The Examiner asserts that Frysz provides teaching, suggestion and motivation to optimize the packing density (i.e., the porosity) of the electrode. Specifically, the Examiner asserts that Frysz teaches that since carbon filaments are small in diameter and exhibit high aspect ratio and high electrical conductivity, fabrication of dense electrodes is possible and that the object of their invention is to increase the energy density by increasing the packing density, or in other words, decreasing porosity. Thus, the Examiner asserts that it would have been obvious to increase the packing density (and thus decrease the porosity) in order to increase the energy density of the electrode.

The rejection should be withdrawn because Frysz does not raise a *prima facie* case of obviousness. Specifically, Frysz does not disclose, teach, or otherwise suggest an electrode having a porosity of 25% or less. Frysz does not disclose any specific values for the porosity of the electrode. Nishimura also does not disclose any specific values for the porosity of the electrode, and thus does not make up for the deficiency of Frysz. Further, the Examiner has not

addressed Applicants' data calculations showing that the electrode of Frysz has a porosity that is substantially higher than 25%.

Although Frysz may provide some motivation to increase the electrode density, one of ordinary skill would assume that the porosity is lowered to about 50% at most based on the disclosure of Frysz, and would not assume a porosity as low as 25%, taking into consideration the problem of permeability of the electrolytic solution. Thus, it is respectfully submitted that the Examiner's reliance on Frysz is merely hindsight, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

IV. Claim Rejections under 35 U.S.C. § 103 based on Nishimura

Claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa.

Claims 3 and 45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Frysz

Claim 31 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, or alternatively under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa and Frysz

Claims 41 and 44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Kubota et al. (U.S. Patent No. 6,139,990).

Claim 45 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Kitagawa et al. (U.S. Patent Application Publication No. US 2002/0061445).

The Examiner maintained the rejections as set forth in the Office Action dated January 10, 2011.

The above rejections should be withdrawn because the present invention is distinct from Nishimura. This is because Nishimura as well as the secondary references do not disclose, either explicitly or inherently, an electrode having a porosity of 25% or less. Namely, Nishimura does not disclose any specific values for the porosity of the electrode. Further, as shown above and in the remarks portion of the Amendment filed May 10, 2011, Ochoa and Frysz also do not disclose an electrode porosity of 25% or less as claimed.

The Examiner commented that she did not cite Nishimura as inherently disclosing an electrode porosity of 25% or less, and that she instead relies on Ochoa as disclosing the porosity range. Thus, the reasoning behind these rejections is essentially the same or similar to the reasoning behind the rejections based on Ochoa.

Thus, as with Ochoa and Frysz, although Nishimura may provide some motivation to increase the electrode density, one of ordinary skill would assume that the porosity is lowered to about 50% at most based on the disclosure of Nishimura (as well as that of Ochoa and Frysz), and would not assume a porosity as low as 25% (taking into consideration a problem of permeability of the electrolytic solution). Thus, it is respectfully submitted that the Examiner's reliance on Nishimura is merely hindsight, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Withdrawal of all rejections and allowance of claims 1-9, 30-34, 38 and 41-45 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Cyril K. Chan
Registration No. 66,504

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: October 24, 2011